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KINGDOM OF BELDIUM
MINISTRY OF ECONOMIC AFFAIRS
PATENT NO. 882,449

INVENTION PATENT

Int. Cl.:	*B 05 B*
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The Minister of Economic Affairs,

In view of the law of May 24, 1854 on patents and inventions;
In view of the affidavit addressed March 26, 1980 at 3:35 p.m. to the Department of Industrial Property;

DEGREES:

Article 1. - That there be granted to the Company known as Ransburg Japan, Ltd., 4-2-3 Nakarokugo, Otu-ku, Tokyo (Japan)

represented by Bureau Gevers S.A., Brussels

A patent of invention for: Electrostatic coating process and rotary device for the atomization of paint for the implementation of this process.

Article 2. - That this patent be granted to them without previous examination, at their risk and peril, without guarantee either as to the reality, the novelty, or the merit of the invention, or as

to the exactitude of the description, and without prejudice to the rights of the third parties.

One of the copies of the specification of the invention (descriptive memorandum and any drawings) signed by the interested party and filed in support of his application will remain attached to the present decree.

Brussels, April 15, 1980
BY SPECIAL DELEGATION:
The Director General
[signature]
L. Salpeteur

Descriptive Statement filed in support of an application for a Patent of Invention on behalf of Ransburg Japan, Ltd. for:

ELECTROSTATIC COATING PROCESS AND ROTARY DEVICE FOR THE ATOMIZATION OF PAINT FOR THE IMPLEMENTATION OF THIS PROCESS

The invention relates to a process for the electrostatic atomization of liquid paint and electrostatic coating of an object by implementation of a rotating device, in particular an atomization device rotating at high speed. The process is designed in such a way as to prevent the formation of foam on the film of paint applied to the object, so as to obtain a high-quality coating. The invention also relates to the rotating atomization devices of the disk type and bell type used for the electrostatic coating.

As of the last few years, there has been an increased tendency towards the use of liquid paints with a low solvent content and

with a relatively high viscosity in order to prevent pollution of the environment. However, in order to atomize satisfactorily a liquid paint with a relatively high viscosity using a rotating device, it is often necessary to make this device turn at an extremely high speed.

In the atomization of a liquid paint using a rotating device, the degree of atomization of the paint is generally inversely proportional to the thickness of the paint film deposited in the form of a thin layer on the circular discharge edge delimiting the surface of the rotating device. Furthermore, the thickness of the film is proportional to the quantity of paint discharged and inversely proportional to the product of the speed of rotation of the atomization device and the radius of the circular discharge edge.

For this reason, when one uses a rotating atomization device which is not very voluminous, of which the radius or that of the circular discharge edge is reduced in order to reduce the dimensions and weight of the device, it is necessary to increase sufficiently the speed of rotation of this device during atomization of a liquid paint, even when the viscosity of the paint is relatively low, in order to obtain satisfactory atomization of this paint or in order to reduce the thickness of the liquid film which forms on the circular discharge edge.

However, when the speed of rotation of the atomization device exceeds 4000 rpm during the electrostatic coating, a large number of bubbles can form on the surface of the paint film applied to the object, depending on the type of paint used, the flow rate of application of the paint, etc. The bubbles affect the quality of the coating obtained, and excessive foam formation can completely spoil the coated object.

The invention relates to a process of electrostatic coating using a rotating atomization device designed to prevent the formation of foam or other imperfections on the paint film applied to the surface of an object, so as to produce a high-quality coating, regardless of the speed of rotation of the atomization device, the type of paint used, the flow rate of discharge of the paint, etc. The invention also relates to a rotating atomization device of the disk type and bell type, designed to prevent the formation of foam on the paint film and to allow one to proceed satisfactorily with the electrostatic coating.

Various factors were mentioned above as being responsible for the formation of foam on paint films. It is assumed that the most significant factors are the physical state of the liquid paint when it is directed towards the circular discharge edge, along the surface of the rapidly turning atomization device, and when it is discharged beyond this edge and atomized. From this assumption and in order to determine clearly the factors involved in foam formation, a certain number of stroboscopic images were taken of the state of the liquid paint on the surface of the rotating atomization device and of the conditions under which this paint is discharged and atomized.

It was thus discovered that when the electrostatic atomization of the paint is normally done by the rotating device, said liquid paint flows towards the circular discharge edge with a cross section in the form of a knife blade oriented outward in an axial direction (in the case of a bell-type device) or in a radial direction (in the case of a disk-type device), thus forming a certain number of "points" (liquid streams). Because of the effect of the electrostatic field generated by the application of a high DC voltage between the discharge edge and the object to be coated,

a small quantity of liquid paint, located at the end of each point, separates, recedes and takes on the form of a small droplet, attaining the state of atomization.

However, when the atomization device turns at high speed and when a certain number of air bubbles form on the paint film applied to the surface of the object, the atomization of the paint by release of small droplets at the end of each of a large number of points formed all along the periphery of the circular discharge edge cannot be obtained. In contrast, it was discovered, as shown in Figure 1 of the appended drawings, that liquid film 3 forms, which is made up of a certain number of irregular triangles whose base is very wide and which project at the periphery of rotating atomization device 1, over the entire circumference of circular discharge edge 2, towards the flared front part and towards the outside. Exterior edge 4 of this liquid film 3 is extremely unstable and reacts in contact with the surrounding air because of the high speed of rotation of the atomization device.

While film 3 is thus turned, folded back, deformed and sucked into the air while reacting with it, it is subjected to the electrostatic field so that its exterior edge 4 tears and divides into spherical pobjects forming a certain number of paint droplets 5, each containing small quantities of air. It was discovered that these paint droplets 5 that hold air are released at the same time as the normal paint droplets 6 with which they are mixed.

It is therefore thought that the formation of foam on the paint film applied to the surface of the object to be coated electrostatically using an atomization device rotating at high speed is due mainly to the fact that a certain number of paint droplets 5 that hold air are drawn towards the object to be coated

by the effect of the electrostatic field, attach to the surface of the object, and hold air in the paint film thus formed.

In order to prevent the formation at the torn exterior edge of the liquid film with triangular and irregular points of paint droplets that hold air, tests were performed with the rotating atomization device of the bell type of which the circumference of the circular discharge edge has a certain number of triangular projections as described in Japanese Patent No. 1266/1961. It appears that when the paint has a relatively low viscosity and when it is discharged in small quantities, each triangular projection supports a liquid film with a approximately triangular shape. Consequently, the exterior edge of each liquid film forms a point at the vertex of the triangular projection or along the exterior edge of its two sides, and the atomization of the paint occurs at the point of each projection.

However, when the viscosity of the liquid paint and the quantity of paint discharged exceed certain critical values (for example, a discharge flow rate of approximately 200 cm^3/min for a paint with the viscosity of 30 sec, measured with the Zahn viscometer provided with a No. 2 cup, and a discharge flow rate of 300 cm^3/min for a paint with a viscosity of 25 sec, measured with the Zahn viscometer provided with a No. 2 cup), it has appeared that the liquid films occupy the intervals between the neighboring pairs of triangular projections and that the exterior edge of each liquid film is turned over or deformed by reaction with the electrostatic field and is at the origin of the formation of paint droplets that hold air, which results in the development of air bubbles or foam on the paint film applied to the object.

Moreover, it was confirmed that, because the rotating atomization device of the bell type described above has a certain

number of triangular projections located over its entire discharge edge and forming a corresponding number of vertices where the electric field strength is high, the potential gradient rises to a dangerous value, so that the device cannot be used in complete safety.

The invention therefore concerns a process designed for preventing the formation of irregular liquid films, such as those indicated above, on the circular discharge edge of the atomization device turning at high speed, in order to eliminate the formation of foam on the film of paint which is deposited. To this effect, the improved process of atomization of liquid paint according to the invention uses a rotating atomization device, which is electrostatically charged and in which the liquid paint, flowing in the form of a continuous thin film over a surface, for example, over the interior surface of the atomizer in the shape of a bell or over the surface of an atomizer in the form of a disk, is divided into a large number of close streams separated from one another in the circumferential direction of the rotating atomizer, such as that represented diagrammatically in Figure 2 of the appended drawings described hereafter.

When the liquid paint thus conducted toward the entire circumference of discharge edges 2, forming a large number of tight and thin streams, reaches said discharge edge, it does not form a liquid film projecting from this edge towards the flared part, towards the front, or towards the outside, as shown in Figure 1, but rather it forms points 7 similar to thin threads which project beyond discharge edge 2 and which correspond to the tight thin stream. The end of each point is atomized and is released in the form of a small droplet 6 not holding any air. The droplet is then driven by the electrostatic forces in order to be applied to the

object. It is thus possible to prevent the formation of foam on the paint film applied to the surface of the object.

According to the invention, the thin and continuous film formed along a surface of the rotating atomization device can be divided into a certain number of tight and thin streams 6 in various ways. A very effective means consists of producing a number of grooves which are not very deep, for example, fine triangular grooves 8 as represented, in the surface on which the liquid paint is directed in the form of a thin film, that is, on the surface of the circumferential wall of the interior cavity of the atomizer of the bell type or on a surface of the atomization disk, in such a way that grooves 8 reach the discharge edge and are oriented approximately in the same direction as that in which the liquid paint flows, that is, approximately in the axial direction, in the case of an atomization bell, and approximately in the radial direction in the case of a disk.

For a rotating atomization device turning at high speeds on the order of 4,000-16,000 rpm, the thickness of the liquid paint flowing along the surface of said device is generally on the order of several tens of micrometers, but does not exceed 100 µm when the discharge flow rate is between approximately 50 and 500 cm^3/min. By giving each of grooves 8 a depth between 0.2 and 0.4 mm, the flowing liquid paint film is divided into thin streams spaced from one another in the circumferential direction by the grooves. A length of approximately 1.5-4 mm is generally sufficient for each groove.

The invention will be described in more detail in reference to the appended drawings given as nonlimiting examples in which:

- Figure 1 is a partial and diagrammatic top view showing the formation of droplets on the circular discharge edge of a rotating atomization device of the prior art;

- Figure 2 is a view similar to that of Figure 1, but showing the discharge edge of the rotating atomization device according to the invention;

- Figure 3 is a partial axial section of an embodiment with a bell of the rotating atomization device according to the invention;

- Figure 4 is a partial axial section of a variant of the rotating atomization device according to the invention;

- Figure 5 is a partial axial section, in enlarged scale, of the discharge edge of the device represented in Figure 4;

- Figure 6 is a partial axial section, in enlarged scale, of the edge of a discharge and atomization disk which is part of a variant of the device according to the invention;

- Figures 7A, 7B, 7C, 8A, 8B, 8C and 8D are partial diagrammatic top views of variants of the discharge edge of the atomization device according to the invention; and

- Figure 9 is a graph showing the average diameter of the droplets of paint atomized using the earlier device and using the device according to the invention.

Figure 3 represents in cross section a first embodiment according to the invention, namely a rotating atomization device of the bell type. This device includes sleeve 12 mounted on the front end of shaft 11 of the device (not represented) which can turn at high speed, that is, approximately 10,000-16,000 rpm under the control of a motor, for example, of the pneumatic type. Disk 13 is attached coaxially to the front end of the sleeve, and cylinder 14 departs coaxially towards the rear of the circumference of disk 13. The pieces described above form hub 16 attached to shaft 11 by lock

nut 15. Paint atomization element 20, of the bell type, has cavity 17 with a circular cross section, which is open towards the front and is delimited by circular discharge edge 18 tapered towards the front. This atomization element 20 is fit coaxially on cylinder 14 of hub 16 and is attached there by locking screw 19. The liquid paint, coming from a suitable supply source (not represented) and arriving through pipe 21 in the space between sleeve 12 and hub 16 and cylinder 14, is directed, under the effect of the high speed rotation of the device, towards the rear end of cavity 17, passing through several holes 22 made at the front end of cylinder 14, and it flows in the form of a thin film, whose thickness is approximately 0.1 mm, along circumferential wall 23 of the cavity.

A certain number of grooves 8 are made along the front part of cavity 17. Each groove has a length of approximately 1.5 mm and a maximum depth of approximately 0.2 to 0.3 mm, so that the grooves reach edge discharge 18. These grooves 8 can be made using a milling tool.

Grooves 8 divide the film of paint, as indicated in the preceding, in such a way that this paint, when it reaches discharge edge 18, is atomized under the effect of the electrostatic field produced by a high DC voltage, for example, a voltage of approximately 80-120 kV, applied between discharge edge 18 and the object to be coated (not represented). The paint is thus deposited electrostatically on the surface of the object.

When the rotating atomization device described above, which has a circular discharge edge with a diameter of 7.3 cm and which turns at high speed, for example, 16,000 rpm, uses a liquid paint with a high viscosity, for example, a viscosity of 30 sec measured with the Zahn viscometer provided with a No. 2 cup, and also used a paint discharge flow rate between approximately 150 and

500 cm^3/min, no foam forms on the paint film which is deposited, and a high quality coating is thus obtained.

In order to determine the effect of grooves 8 on the dark currents, tests consisting of measuring these currents were done on the rotating atomization device of the bell type according to the invention and on devices of the prior art. The device according to the invention used for these tests is similar to that shown in Figure 3 and has a large number of grooves with a length of approximately 1.5 mm and a maximum depth of approximately 0.2-0.3 mm. The device of the prior art also used for these tests has the same shape and the same dimensions as those of the device shown in Figure 3, but does not have grooves 8.

When the liquid paint is atomized in small droplets and sprayed on the object, the quality of the film or of the coating of paint formed on this object generally depends on the maximum and average diameters of the droplets of atomized paint. When the maximum diameter of these droplets is large, the quality of the film applied to the object decreases according to the following relationship, empirically determined, consequently established between the maximum diameter of the pobjects and the quality of the paint film:

Maximum pobject diameter	Paint film quality
100-200 μm	excellent
200-300 μm	good
300-450 μm	rather poor
more than 450 μm	poor

In order to form a paint film of excellent quality, it is necessary that the maximum and average diameters of the droplets of atomized paint be small. However, when atomized paint contains a large quantity of droplets of extremely small diameter, the result obtained is not particularly good because the solvent evaporates rapidly from these droplets when they are directed toward the object to be coated. Consequently, the considerable solidification of the resin and of the pigment leads to a reduction in the quality of the paint film. It is therefore desirable for the maximum diameter of the droplets of atomized paint to be adjusted to a small value, for example, a value in the range of 100-200 μm indicated above, and for the diameters of the majority of the droplets to be adjusted to similar values.

In the conventional rotating atomization devices used for electrostatic coating, the diameters of the droplets of atomized paint can vary over a wide range depending on various factors such as the type of resin used, the type of solvent, the type of pigment, the viscosity of the paint at the time of use, the electrical resistance and the discharge flow rate of this paint, the diameter and the speed of rotation of the atomization device and the value of the DC voltage applied between the device and the object to be coated.

In the case of water-based paint and paint with a high solid content and a low content of volatile substances, the use of which has increased in the last years in the context of the fight against pollution of the environment, it is often difficult, if not impossible, to obtain droplets of the desired diameter. Even in the case of conventional synthetic paints of various types used in numerous industrial domains, it is sometimes impossible to obtain droplets of the desired diameter.

The diameter of the droplets of liquid paint atomized by the rotating device used for the electrostatic coating depend on the number and the thickness of the points (liquid streams) formed at the discharge edge of the atomization device. The diameter of the droplets of paint is large when the number of points is low and these points are thick, and the diameter of the droplets is small when the number of points is large and their thickness is small. In general, the thickness of the points depends on the thickness of the paint film at the discharge edge according to the following relationship:

$$\text{Thickness of the paint film} \equiv \frac{\text{Discharge flow rate} \times \text{Viscosity}}{\text{Diameter of the rotating body} \times \text{Speed of rotation}}$$

In order to easily obtain the desired maximum and average diameters of the paint pobjects, it has appeared that the rotating atomization device, rather than having the conventional rounded or tapered front edge, must have a front edge or discharge edge whose width, considered perpendicularly to the surface on which the paint flows, is small and uniform. Several grooves whose depth is small and increases progressively are advantageously made along the interior peripheral surface on which the paint flows. By using such an embodiment and its variants, certain ones of which are represented in Figures 4, 5, 6, 7A, 7B, 7C, 8A, 8B, 8C and 8D, the length of the interior peripheral surface of the discharge edge of the rotating atomization device is considerably increased with respect to that of the conventional rotating devices. Consequently, the circumference of the film of paint arriving at the discharge end of the atomization device is considerably increased, and its

thickness is therefore considerably reduced. This results in an increase of the number of points formed and a decrease in the diameter of these points. So droplets of atomized paint having a low maximum diameter and diameters varying over a narrow range form in a stable manner over the entire circumference of the circular end and this results in an improvement of the quality of the paint film deposited on the object.

Measurements of the dark current were made on each of these two devices using two electrodes, one in the form of a plate and one in the form of a needle with a diameter of 0.7 mm, opposite one another. The distance D between the device and the electrode and the DC voltage V applied to the device are varied while the quantity of paint discharged is zero (the dark current then being greater than that obtained during the discharge of paint).

The results obtained are given in the following table. It is thus confirmed that the increase in the dark current, due to the presence of the grooves, is extremely low and is not the cause of the appearance of any danger.

Experimental results of the measurement of the dark current

Electrode	Tension V (3) / Courant (4) / Distance D	-90 kV Invention	-90 kV (5) Art antérieur	-120 kV Invention	-120 kV (5) Art antérieur
(1) Plaque	20 cm	210 µA	200 µA	440 µA	420 µA
	25 cm	170 "	160 "	320 "	[illegible] "
	30 cm	120 "	120 "	280 "	[illegible]70 "
(2) Aiguille	20 cm	250 µA	230 µA	700 µA	[illegible]00 µA
	25 cm	170 "	160 "	420 "	420 "
	30 cm	120 "	120 "	320 "	310 "

Key: 1 Plate
2 Needle
3 Voltage V
4 Current
5 Prior art

Figure 4 is an elevation, in partial cross section, of a small rotating atomization device produced according to the invention. This device includes hub 36 which has sleeve 32 mounted on the front end of shaft 31 of rotary drive element (not represented), for example, a pneumatic motor which can turn at high speed, for example, between 10,000 and 18,000 rpm. Disk 33 is attached coaxially on the front end of sleeve 32, and cylinder 34 projects coaxially from the periphery of disk 33. Hub 36 formed by these elements is attached to shaft 31 by means of nut 35. Paint atomization bell 39, with a small diameter and a circular cross

section, has cavity 37 whose front end is open and delimited by circular discharge edge 38. This bell 39 is attached to hub 36 by coaxial fitting of the rear end of said bell 39 on cylinder 34 of hub 36, and by locking using screw 40. A liquid paint, coming from a suitable supply source (not represented), arrives in annular chamber 42 delimited by sleeve 32 and cylinder 34 of hub 36, by means of pipe 41. Under the effect of the high speed of rotation of shaft 31, this paint penetrates into the rear end of cavity 37 of bell 39, passing through several holes 43 made in the wall of cylinder 34, and it is directed, along interior surface 44 of cavity 37, towards discharge end 38, forming a thin film whose thickness is generally less than approximately 0.1 mm. The paint film thus directed towards discharge end 38 is atomized by the electrostatic field created between this end 38 and the object to be coated (not represented), with application of a high DC voltage, for example, between 80 and 100 kV, between bell 39 and said object, by means of a suitable high DC voltage source (not represented). The atomized paint thus obtained is deposited electrostatically on the surface of the object.

Circular discharge edge 38 has narrow end surface 45 whose width, measured approximately perpendicularly to the periphery or to the front end of interior surface 44 delimiting cavity 37, is uniform, as shown in Figure 5. The front part of interior surface 44 has several grooves 46 oriented in the direction of the liquid paint flow along interior surface 44, and these grooves 46 are close together and approximately equidistant. Their exterior ends open at end discharge surface 45. Grooves 46 can have, in a top view, an elongated shape. It is preferable, however, for their shape to be such that their width and their depth increase progressively from their interior end toward their exterior

periphery. For example, the grooves can have the shape of an elongated V (Figure 7A), an elongated U (Figure 7B), or of an elongated V whose axis is curved or in the form of the arc of circle (Figure 7C). Grooves 46 can have different cross-sectional profiles as shown in Figures 8A, 8B, 8C, and 8D, for example, a V-shaped profile (Figures 8A and 8C), a U-shaped profile (Figure 8B) or a trapezoidal profile (Figure 8D). Grooves 46 can be made with a constant depth, although it is preferable for their depth to increase progressively from their interior end towards their exterior end.

Figure 6 is a partial axial section on an enlarged scale showing the peripheral part of disk 47 for discharge and atomization of paint, produced according to the invention. In this device, the circular discharge end is also produced in such a way that it has narrow end surface 45 whose width, measured perpendicularly to interior surface 48 of disk 47 or to the surface on which a liquid paint flows toward the discharge end, is uniform. The peripheral part of interior surface 48 has several grooves 46 oriented approximately radially, close to one another and equidistant, so that their exterior end opens on end surface 45.

The following examples relate to rotating atomization devices produced according to the invention and give numerical values for the width b of end surface 45 of the circular discharge edge, for depth d of the exterior end of grooves 46 opening on end surface 45, for pitch P or the distance between the central axes of grooves 46 and for length l of these grooves 46.

Example I

A small paint atomization bell, with a diameter of 4-10 cm, has the following characteristics:

Width b of the surface of the discharge end:	0.2-1.0 mm
Depth d of the exterior end of the grooves:	0.1-0.4 mm
Pitch P of the grooves:	0.2-1.0 mm
Length l of the grooves:	1.0-10 mm

Example II

A paint atomization device of the type with a bell or a disk, having a diameter of 10 to 64 cm, has the following characteristics:

Width b of the surface of the discharge end:	0.2-4 mm
Depth d of the exterior end of the grooves:	0.1-3 mm
Pitch P of the grooves:	0.2-3 mm
Length l of the grooves:	1.0-15 mm.

In the preceding examples, the thickness of the paint film directed towards the discharge end, along the interior surface of the discharge and atomization element, is generally several tens of micrometers, but does not exceed 100 μm.

Tests were done with a rotating atomization bell 39, similar to that represented in Figure 4, having a diameter of approximately 7.3 cm, and a discharge end 38 and an end surface 45 with a width b of 1.0 mm. Grooves 46 have, in a top view and in cross section, the profile shown in Figures 7A and 8A and have a depth d of 0.1-0.4 mm, a pitch P of 1.0 mm and a length between 1 and 5 mm. A 90 kV DC voltage is applied between discharge end 38 and the object

to be coated, and bell 39 is rotated at a speed varying from 7,000-18,000 rpm. The results show that when various types of paint, with viscosities between 15 and 50 sec at 20°C, measured using a Zahn viscometer with a No. 2 cup, are subjected to atomization at discharge flow rates of 50-700 cm^3/min, small droplets of atomized paint are obtained with a maximum diameter less than 200 µm and diameters varying over a narrow range or which are approximately equal.

Curve I of Figure 9 shows the distribution of the diameters of the droplets of atomized paint obtained using bell 39 indicated above and turning at 16,000 rpm and with a paint whose viscosity is 25 sec at 20°C, determined with the Zahn viscometer with a No. 2 cup, the paint discharge flow rate being 450 cm^3/min. Curve I shows that the average diameter of the droplets is approximately 100 µm and that the diameters of the droplets can vary by approximately 20 µm.

Curve II indicates an average diameter of the droplets of approximately 150 µm and a variation of the diameters of the droplets by approximately 60 µm. This curve represents the distribution of the diameters of droplets of atomized paint obtained under the same conditions as those indicated above, but with a conventional rotating atomization bell with the same diameter as that of the bell mentioned in the preceding, but whose annular discharge edge is in the form of a blade and whose interior peripheral surface does not have grooves. By comparing curves I and II, it appears that the invention allows one to obtain much better results than those obtained with the conventional rotating atomization devices of the prior art.

It goes without saying that the devices described and represented can be modified in numerous ways without deviating from scope of the invention.

Claims

1. Process for atomization of a liquid paint using a rotating atomization device in order to electrostatically coat an object with a homogeneous and smooth film of liquid paint, an electrostatic field being established between the peripheral edge of the rotating device and the object to be coated, and the liquid paint flowing towards the edge of the device in the form of a thin and continuous film, characterized by the fact that it consists of reducing considerably the thickness of the paint film when it reaches the peripheral edge by making this film flow over several grooves spaced radially, oriented approximately in the direction of flow of the paint, and ending at the discharge edge, and of atomizing the liquid paint film when it is projected beyond said peripheral edge.

2. Process according to Claim 1, characterized by the fact that the thickness of the paint film reaching the peripheral edge does not exceed 100 µm.

3. Process for atomization of liquid paint using a rotating atomization device in order to coat electrostatically an object with a homogeneous and smooth liquid paint film, an electrostatic field being established between the peripheral edge of the rotating device and the object to be coated, and the liquid paint flowing toward the edge of said device in the form of a thin and continuous film, characterized by the fact that it consists of dividing the thin film of liquid paint into several close streams flowing in the

peripheral direction of the edge of the device, and of atomizing the liquid paint streams when it is projected beyond the edge of the device.

4. Process according to Claim 3, characterized by the fact that the thickness of the paint streams reaching the peripheral edge does not exceed 100 µm.

5. Rotating atomization device, which is electrostatically charged and intended to coat objects, having a circular discharge edge and intended for mounting on a rotating shaft in order to be put in rotation at high speed so that the liquid paint, introduced into this device, forms a thin and continuous film flowing toward said circular discharge body, characterized by the fact that the peripheral part of its surface on which the liquid paint flows has several radial grooves whose depth increases in the direction of flow of the paint and which end at the discharge edge.

6. Device according to Claim 5, characterized by the fact that the device is in the form of a bell.

7. Device according to Claim 5, characterized by the fact that the device is in the form of a disk.

8. Rotating atomization device, which is electrostatically charged and intended to coat objects with liquid paint, having a circular discharge edge and intended for mounting on a shaft which makes it turn, characterized by the fact that the circular discharge edge has a flat and narrow end surface, oriented approximately perpendicular to the surface on which the liquid paint flows toward said circular discharge edge, the latter surface having several grooves which are not very deep, which are oriented approximately in the direction of the flow of the paint and which reach the circular discharge edge where they open in the perpendicular end surface.

9. Device according to Claim 8, characterized by the fact that it is has the form of a bell and by the fact that the grooves are oriented approximately parallel to the axis of this device.

10. Device according to Claim 8, characterized by the fact that it has the form of an approximately flat disk and by the fact that the grooves are oriented approximately in the radial direction of this device.

11. Device according to any one of Claims 8, 9, and 10, characterized by the fact that each groove has a width and depth which increase progressively toward the circular discharge edge of the device.

12. Rotating paint atomization device, with an electrostatic charge, used for coating objects and having a circular discharge edge, intended for mounting on a rotating shaft for high speed rotation such that it leads liquid paint provided to the interior of the device to be formed into a thin continuous film which flows toward its circular discharge edge, characterized by the fact that the peripheral part of the surface of the atomization device on which the liquid paint flows is made in the form of a peripheral series of grooves whose depth increases in the direction of the paint flow and which end on the discharge edge, these grooves having a length of 1-15 mm and a depth on the discharge edge of 0.1-3 mm.

13. Device according to Claim 12, characterized by the fact that the device has the form of a bell.

14. Device according to Claim 12, characterized by the fact that the device has the form of a disk.

15. Rotating atomization device with electrostatic charge, used for coating objects with liquid paint, having a circular discharge edge and intended for mounting on a rotating shaft for

its rotation, characterized by the fact that the circular discharge edge has a flat and narrow end surface generally perpendicular to the surface of the device along which the liquid paint flows towards the circular discharge edge, and by the fact that the surface along which the liquid paint flows has a number of grooves which are not very deep, each one of which extends practically in the direction of flow of the liquid paint and reaches the circular discharge edge in order to open in the perpendicular end surface.

16. Device according to Claim 15, characterized by the fact that the rotating device has the form of a bell, and each of the grooves extends approximately parallel to the axis of the rotating device.

17. Device according to Claim 15, characterized by the fact that it is made as a practically flat disk, and each of the grooves extends approximately in the radial direction of the rotating device.

18. Device according to any one of Claims 15-17, characterized by the fact that the multiple grooves each have a length of 1-15 mm, a depth on the discharge edge of 0.1-3 mm, and a pitch between 0.2 and 3 mm.

19. Process and device for atomization of paint, as described above or according to the appended drawings.

Brussels, March 26, 1980
per pro. Ransburg Japan, Ltd.
per pro. Bureau Geveis S.A.
[signature]

Figure 1

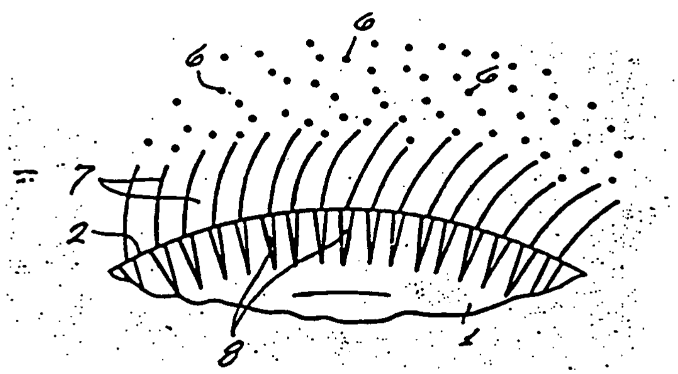


Figure 2

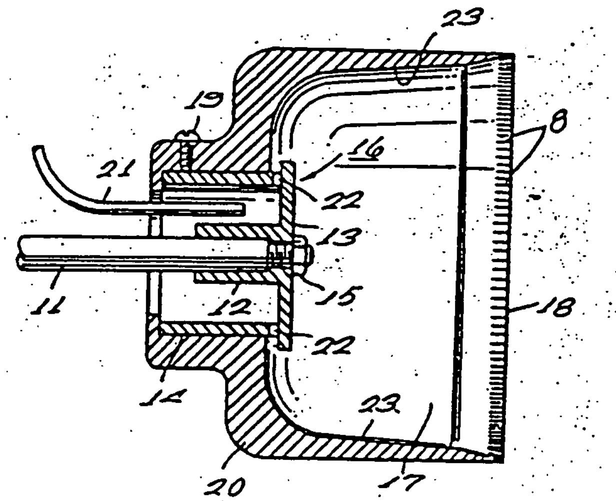


Figure 3

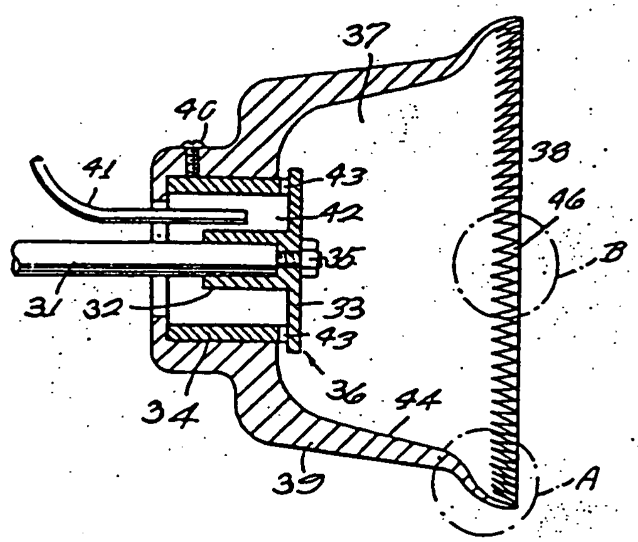


Figure 4

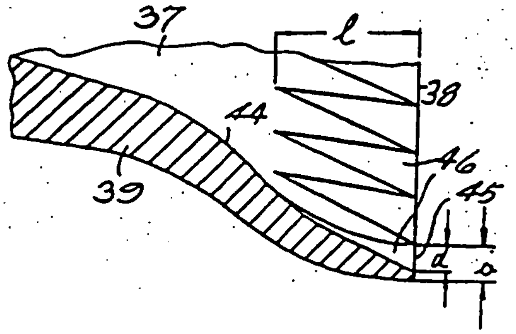
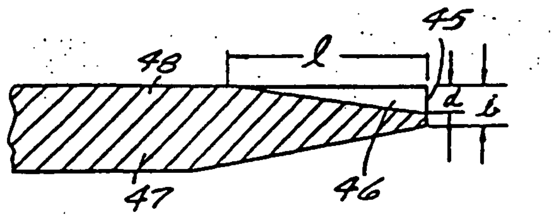


Figure 5



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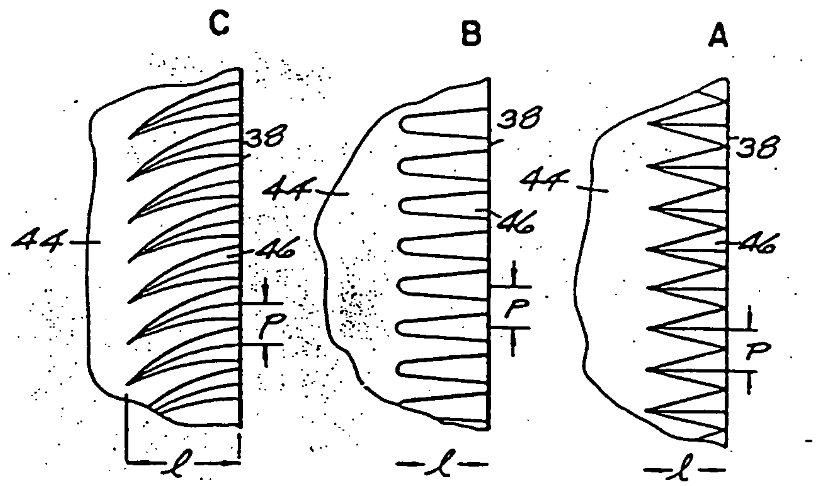

Figure 7

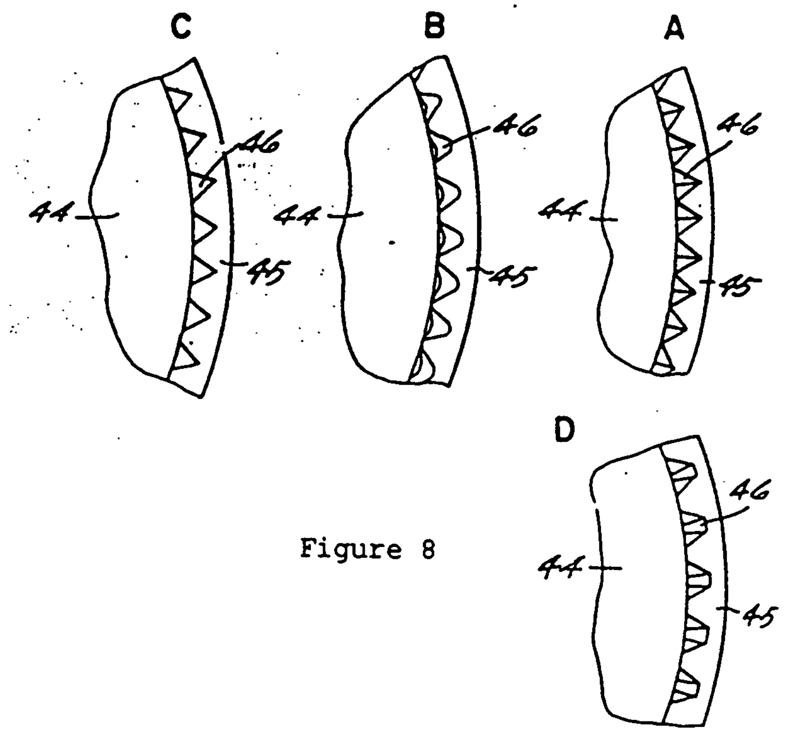

Figure 8

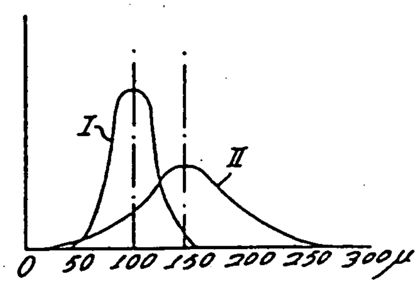

Figure 9